

Cardiovascular technologists and technicians spend a lot of time walking and standing. Those who work in catheterization labs may face stressful working conditions, because they are in close contact with patients who have serious heart ailments. Some patients, for example, may encounter complications from time to time that have life or death implications.

### Employment

Cardiovascular technologists and technicians held about 33,000 jobs in 1998. Most worked in hospital cardiology departments, whereas some worked in cardiologists' offices, cardiac rehabilitation centers, or ambulatory surgery centers. About one-third were EKG technicians.

### Training, Other Qualifications, and Advancement

Although some cardiovascular technologists, vascular technologists, and echocardiographers are currently trained on the job, an increasing number receive training in 2- to 4-year programs. Cardiology technologists normally complete a 2-year junior or community college program. One year is dedicated to core courses followed by a year of specialized instruction in either invasive, noninvasive, or noninvasive peripheral cardiology. Those who are qualified in a related allied health profession only need to complete the year of specialized instruction. Graduates from programs accredited by the Joint Review Committee on Education in Cardiovascular Technology are eligible to register as professional technologists with the American Registry of Diagnostic Medical Sonographers or Cardiovascular Credentialing International.

For basic EKGs, Holter monitoring, and stress testing, 1-year certificate programs exist; but most EKG technicians are still trained on the job by an EKG supervisor or a cardiologist. On-the-job training usually lasts about 8 to 16 weeks. Most employers prefer to train people already in the health care field—nursing aides, for example. Some EKG technicians are students enrolled in 2-year programs to become technologists, working part-time to gain experience and make contact with employers.

Cardiovascular technologists and technicians must be reliable, have mechanical aptitude, and be able to follow detailed instructions. A pleasant, relaxed manner for putting patients at ease is an asset.

### Job Outlook

Employment of cardiovascular technologists and technicians is expected to grow as fast as the average for all occupations through the year 2008, with technologists and technicians experiencing different patterns of employment change.

Employment of *cardiology technologists* is expected to grow much faster than the average for all occupations. Growth will occur as the population ages, because older people have a higher incidence of heart problems. Likewise, employment of vascular technologists will grow faster than the average, as advances in vascular technology reduce the need for more costly and invasive procedures.

In contrast, employment of *EKG technicians* is expected to decline, as hospitals train nursing aides and others to perform basic EKG procedures. Individuals trained in Holter monitoring and stress testing are expected to have more favorable job prospects than those who can only perform a basic EKG.

Some job openings for cardiovascular technologists and technicians will arise from replacement needs, as individuals transfer to other jobs or leave the labor force. Relatively few job openings, due to both growth and replacement needs are expected, however, because the occupation is small.

### Earnings

Median annual earnings of cardiology technologists were \$35,770 in 1998. The middle 50 percent earned between \$29,060 and \$42,350 a year. The lowest 10 percent earned less than \$23,010 and the

highest 10 percent earned more than \$49,780 a year. Median annual earnings of cardiology technologists in 1997 were \$34,500 in hospitals.

Median annual earnings of EKG technicians were \$24,360 in 1998. The middle 50 percent earned between \$19,660 and \$30,860 a year. The lowest 10 percent earned less than \$16,130 and the highest 10 percent earned more than \$39,060 a year. Median annual earnings of EKG technicians in 1997 were \$23,200 in hospitals.

### Related Occupations

Cardiovascular technologists and technicians operate sophisticated equipment that helps physicians and other health practitioners diagnose and treat patients. So do nuclear medicine technologists, radiologic technologists, diagnostic medical sonographers, electroneurodiagnostic technologists, perfusionists, radiation therapists, and respiratory therapists.

### Sources of Additional Information

For general information about a career in cardiovascular technology contact:

✦ Alliance of Cardiovascular Professionals, 910 Charles St., Fredericksburg, VA 22401.

For a list of accredited programs in cardiovascular technology, contact:

✦ Joint Review Committee on Education in Cardiovascular Technology, 3525 Ellicott Mills Dr., Suite N, Ellicott City, MD 21043-4547.

For information on vascular technology, contact:

✦ The Society of Vascular Technology, 4601 Presidents Dr., Suite 260, Lanham, MD 20706-4365.

For information on echocardiography, contact:

✦ American Society of Echocardiography, 4101 Lake Boone Trail, Suite 201, Raleigh, NC 27607.

For information regarding registration and certification contact:

✦ Cardiovascular Credentialing International, 4456 Corporation Lane, Suite 110, Virginia Beach, VA 23462.

✦ American Registry of Diagnostic Medical Sonographers, 600 Jefferson Plaza, Suite 360, Rockville, MD 20852-1150.

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## Clinical Laboratory Technologists and Technicians

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(O\*NET 32902, 32905, and 66099D)

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### Significant Points

- Medical and clinical laboratory technologists usually have a bachelor's degree with a major in medical technology or in one of the life sciences; medical and clinical laboratory technicians need either an associate's degree or a certificate.
- Competition for jobs has increased, and individuals may now have to spend more time seeking employment than in the past.

### Nature of the Work

Clinical laboratory testing plays a crucial role in the detection, diagnosis, and treatment of disease. Clinical laboratory technologists and technicians, also known as medical technologists and technicians, perform most of these tests.

Clinical laboratory personnel examine and analyze body fluids, tissues, and cells. They look for bacteria, parasites, and other microorganisms; analyze the chemical content of fluids; match blood for transfusions, and test for drug levels in the blood to show how a patient is responding to treatment. These technologists also prepare specimens for examination, count cells, and look for abnormal

cells. They use automated equipment and instruments capable of performing a number of tests simultaneously, as well as microscopes, cell counters, and other sophisticated laboratory equipment. Then they analyze the results and relay them to physicians. With increasing automation and the use of computer technology, the work of technologists and technicians has become less hands-on and more analytical.

The complexity of tests performed, the level of judgment needed, and the amount of responsibility workers assume depend largely on the amount of education and experience they have.

*Medical and clinical laboratory technologists* generally have a bachelor's degree in medical technology or in one of the life sciences, or they have a combination of formal training and work experience. They perform complex chemical, biological, hematological, immunologic, microscopic, and bacteriological tests. Technologists microscopically examine blood, tissue, and other body substances. They make cultures of body fluid and tissue samples, to determine the presence of bacteria, fungi, parasites, or other microorganisms. They analyze samples for chemical content or reaction and determine blood glucose and cholesterol levels. They also type and cross match blood samples for transfusions.

Medical and clinical laboratory technologists evaluate test results, develop and modify procedures, and establish and monitor programs, to insure the accuracy of tests. Some medical and clinical laboratory technologists supervise medical and clinical laboratory technicians.

Technologists in small laboratories perform many types of tests, whereas those in large laboratories generally specialize. Technologists who prepare specimens and analyze the chemical and hormonal contents of body fluids are *clinical chemistry technologists*. Those who examine and identify bacteria and other microorganisms are *microbiology technologists*. *Blood bank technologists* collect, type, and prepare blood and its components for transfusions. *Immunology technologists* examine elements and responses of the human immune system to foreign bodies. *Cytotechnologists* prepare slides of body cells and microscopically examine these cells for abnormalities that may signal the beginning of a cancerous growth.

*Medical and clinical laboratory technicians* perform less complex tests and laboratory procedures than technologists. Technicians may prepare specimens and operate automatic analyzers, for example, or they may perform manual tests following detailed instructions. Like technologists, they may work in several areas of the clinical laboratory or specialize in just one. *Histology technicians* cut and stain tissue specimens for microscopic examination by pathologists, and *phlebotomists* collect blood samples. They usually work under the supervision of medical and clinical laboratory technologists or laboratory managers.



A laboratory technologist examines a blood sample as part of her evaluation at a blood bank.

## Working Conditions

Hours and other working conditions vary, according to the size and type of employment setting. In large hospitals or in independent laboratories that operate continuously, personnel usually work the day, evening, or night shift and may work weekends and holidays. Laboratory personnel in small facilities may work on rotating shifts, rather than on a regular shift. In some facilities, laboratory personnel are on call several nights a week or on weekends, available in case of emergency.

Clinical laboratory personnel are trained to work with infectious specimens. When proper methods of infection control and sterilization are followed, few hazards exist.

Laboratories usually are well lighted and clean; however, specimens, solutions, and reagents used in the laboratory sometimes produce odors. Laboratory workers may spend a great deal of time on their feet.

## Employment

Clinical laboratory technologists and technicians held about 313,000 jobs in 1998. About half worked in hospitals. Most of the remaining jobs were found in medical laboratories or offices and clinics of physicians. A small number were in blood banks, research and testing laboratories, and in the Federal Government—at Department of Veterans Affairs hospitals and U.S. Public Health Service facilities. About 1 laboratory worker in 5 worked part time.

## Training, Other Qualifications, and Advancement

The usual requirement for an entry level position as a medical or clinical laboratory technologist is a bachelor's degree with a major in medical technology or in one of the life sciences. Universities and hospitals offer medical technology programs. It is also possible to qualify through a combination of on-the-job and specialized training.

Bachelor's degree programs in medical technology include courses in chemistry, biological sciences, microbiology, mathematics, and specialized courses devoted to knowledge and skills used in the clinical laboratory. Many programs also offer or require courses in management, business, and computer applications. The Clinical Laboratory Improvement Act (CLIA) requires technologists who perform certain highly complex tests to have at least an associate's degree.

Medical and clinical laboratory technicians generally have either an associate's degree from a community or junior college or a certificate from a hospital, vocational or technical school, or from one of the Armed Forces. A few technicians learn their skills on the job.

Nationally recognized accrediting agencies in clinical laboratory science include the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS), the Commission on Accreditation of Allied Health Education Programs (CAAHEP), and the Accrediting Bureau of Health Education Schools (ABHES). The NAACLS fully accredits 288 and approves 249 programs providing education for medical and clinical laboratory technologists, histologic technicians, and medical and clinical laboratory technicians. ABHES accredits training programs for medical and clinical laboratory technicians.

Some States require laboratory personnel to be licensed or registered. Information on licensure is available from State departments of health or boards of occupational licensing. Certification is a voluntary process by which a nongovernmental organization, such as a professional society or certifying agency, grants recognition to an individual whose professional competence meets prescribed standards. Widely accepted by employers in the health industry, certification is a prerequisite for most jobs and often is necessary for advancement. Agencies certifying medical and clinical laboratory technologists and technicians include the Board of Registry of the American Society of Clinical Pathologists, the American Medical Technologists, and the Credentialing Commission of the International Society for Clinical

Laboratory Technology. These agencies have different requirements for certification and different organizational sponsors.

Clinical laboratory personnel need good analytical judgment and the ability to work under pressure. Close attention to detail is essential, because small differences or changes in test substances or numerical readouts can be crucial for patient care. Manual dexterity and normal color vision are highly desirable. With the widespread use of automated laboratory equipment, computer skills are important. In addition, technologists in particular are expected to be good at problem solving.

Technologists may advance to supervisory positions in laboratory work or become chief medical or clinical laboratory technologists or laboratory managers in hospitals. Manufacturers of home diagnostic testing kits and laboratory equipment and supplies seek experienced technologists to work in product development, marketing, and sales. Graduate education in medical technology, one of the biological sciences, chemistry, management, or education usually speeds advancement. A doctorate is needed to become a laboratory director. However, federal regulation allows directors of moderate complexity laboratories to have either a master's degree or a bachelor's degree combined with the appropriate amount of training and experience. Technicians can become technologists through additional education and experience.

Job Outlook

Employment of clinical laboratory workers is expected to grow about as fast as the average for all occupations through the year 2008, as the volume of laboratory tests increases with population growth and the development of new types of tests. Hospitals and independent laboratories have recently undergone considerable consolidation and restructuring, to boost productivity and allow the same number of personnel to perform more tests than previously possible. Consequently, competition for jobs has increased; and individuals may now have to spend more time seeking employment than in the past.

Technological advances will continue to have two opposing effects on employment through 2008. New, increasingly powerful diagnostic tests will encourage additional testing and spur employment. However, advances in laboratory automation and simple tests, which make it possible for each worker to perform more tests, should slow growth. Research and development efforts are targeted at simplifying routine testing procedures, so nonlaboratory personnel, physicians and patients, in particular, can perform tests now done in laboratories. In addition, automation may be used to prepare specimens, a job traditionally done by technologists and technicians.

Although significant, growth will not be the only source of opportunities. As in most occupations, many openings will result from the need to replace workers who transfer to other occupations, retire, or stop working for some other reason.

Earnings

Median annual earnings of clinical laboratory technologists and technicians were \$32,440 in 1998. The middle 50 percent earned between \$24,970 and \$39,810 a year. The lowest 10 percent earned less than \$19,380 and the highest 10 percent earned more than \$48,290 a year. Median annual earnings in the industries employing the largest numbers of medical and clinical laboratory technologists in 1997 were:

Offices and clinics of medical doctors .....	\$40,300
Federal Government .....	39,600
Hospitals .....	36,500
Medical and dental laboratories .....	35,600

Median annual earnings in the industries employing the largest numbers of medical and clinical laboratory technicians in 1997 were:

Hospitals .....	\$26,600
Offices and clinics of medical doctors .....	25,500
Medical and dental laboratories .....	24,800
Health and allied services, not elsewhere classified .....	22,400

Related Occupations

Clinical laboratory technologists and technicians analyze body fluids, tissue, and other substances using a variety of tests. Similar or related procedures are performed by analytical, water purification, and other chemists; science technicians; crime laboratory analysts; food testers; and veterinary laboratory technicians.

Sources of Additional Information

Career and certification information is available from:

- ☛ American Society of Clinical Pathologists, Board of Registry, P.O. Box 12277, Chicago, IL 60612. Internet: <http://www.ascp.org/bor>
- ☛ American Medical Technologists, 710 Higgins Rd., Park Ridge, IL 60068. Internet: <http://www.amt1.com>
- ☛ American Society of Cytopathology, 400 West 9th St., Suite 201, Wilmington, DE 19801.
- ☛ International Society for Clinical Laboratory Technology, 917 Locust St., Suite 1100, St. Louis, MO 63101-1413.

For more career information, write to:

- ☛ American Society for Clinical Laboratory Science, 7910 Woodmont Ave., Suite 530, Bethesda, MD 20814.
- ☛ American Association of Blood Banks, 8101 Glenbrook Rd., Bethesda, MD 20814-2749.

For a list of accredited and approved educational programs for clinical laboratory personnel, write to:

- ☛ National Accrediting Agency for Clinical Laboratory Sciences, 8410 W. Bryn Mawr Ave., Suite 670, Chicago, IL 60631.

For a list of training programs for medical and clinical laboratory technicians accredited by the Accrediting Bureau of Health Education Schools, write to:

- ☛ Accrediting Bureau of Health Education Schools, 803 West Broad St., Suite 730, Falls Church, VA 22046. Internet: <http://www.abhes.org>

For information about a career as a medical and clinical laboratory technician and schools offering training, contact:

- ☛ National Association of Health Career Schools, 2301 Academy Dr., Harrisburg, PA 17112.

Dental Hygienists

(O\*NET 32908)

Significant Points

- Dental hygienists are projected to be one of the 30 fastest growing occupations.
- Population growth and greater retention of natural teeth will stimulate demand for dental hygienists.
- Opportunities for part-time work and flexible schedules are common.

Nature of the Work

Dental hygienists clean teeth and provide other preventive dental care, as well as teach patients how to practice good oral hygiene. Hygienists examine patients' teeth and gums, recording the presence of diseases or abnormalities. They remove calculus, stains, and plaque from teeth; take and develop dental x rays; and apply cavity preventive agents such as fluorides and pit and fissure sealants. In some States, hygienists administer local anesthetics and anesthetic gas; place and carve filling materials, temporary fillings, and periodontal dressings; remove sutures; and smooth and polish metal restorations.

Dental hygienists also help patients develop and maintain good oral health. For example, they may explain the relationship between diet and oral health, inform patients how to select toothbrushes, and show patients how to brush and floss their teeth.

Dental hygienists use hand and rotary instruments, lasers, and ultrasonics to clean teeth; x-ray machines to take dental pictures; syringes with needles to administer local anesthetics; and models of teeth to explain oral hygiene.